Data extracted from July 1999 AWS WELDING JOURNAL Pages 37 & 38
Article entitled: How Weld Hose Materials Affect Welding Gas Quality

Table 2 - Permeability Coefficient of Common Polymers (Plastics)

Permeability Coefficients at **25°C (P X 10^{10})**

Polymer	Common/Trade Name	Oxygen	Moisture
Poly(isoprene)	Natural Rubber	23.3	2290
Poly (chloroprene)	Neoprene G	4.0	910
Poly(isobutene-coisonrene)	Butyl Rubber	1.3	110
Poly(vinyl chloride)	PVC (unplasticized)	0.045	275
Poly(tetrafluoroethylene)	Teflon	4.2	4.8
Poly(tetrafluoroethylene-co)	Teflone FEP	4.9	17
Poly(ethylene), low density (0.914 g/cm3)	LDPE	2.2	68
Poly(ethylene), high density (0.964 g/cm3)	HDPE	0.3	9
Poly(propylene) density (0.907 g/cm3)	PP	1.2	35
Poly(vinyledene chloride)	Saran	0.005	0.5
Poly(trifluoro chloroethylene)	Kel-F81	0.04	0.1
Polylethyl methacrylate)	Plexiglas	1.2	3200
Poly(carbonate)	Lexan	1.4	1400
Polylethylene terephthalate)	PET	0.035	130

Permeability Coefficient P ~ (amount of permeate) (film thickness) / (surface area) (time) (pressure-drop across film).
Units of P: [cm^3 • cm] / [cm^2 • s • (cm Hg)].

Table 3 - Effect of Polymer Density/Crystallinity on Permeation

			Permeation Constant P at 30°C (P X 10^{10})		
Polymer	**Density g/cm^3**	Crystallinity %	Oxygen	Nitrogen	Carbon Dioxide
Polyethylene 0.922	60	5.5	1.9		25.2
	0.938	69	2.1	0.66	7.4
	0.954	78	1.1	0.33	4.3
	0.96	81	1.06	0.27	3.5
	0,965	83	0.5	-	2.5
Polypropylene	0.907	~50	2.1	0.42	8.4

Permeability Coefficient P (amount of permeate) (film thickness) / (surface area) (time) (pressure-drop across film). Units of P: [cm^3 • cm] / [cm^2 • s • (cm Hg)].

Permeation Properties

Permeation through plastics is primarily dependent upon the following properties:

1. ***Exposed surface area.*** The longer the hose or the bigger the hose diameter, the greater the permeation.
2. ***Length of diffusion path.*** The longer the path for the impurity to diffuse, the less the permeation. Thick-walled hoses allow less permeation.
3. ***Material of construction.*** The stiffer the hose, the less the permeation.
4. ***Nature of contaminant.*** Except for Teflon, most plastics allow a much higher degree of moisture permeation than oxygen permeation.
5. ***Humidity. The*** higher the humidity of the surroundings, the greater the moisture permeation. Moisture permeation at 90% relative humidity will be double the permeation at 45% relative humidity (at the same room temperature).
6. ***Temperature.*** The higher the room temperature, the higher the moisture permeation (at the same relative humidity). For example, the moisture permeation rate at 95°F (35°C) is approximately double the rate at 75°F (24°C). Welding on hot, humid days may result in more weld defects.
7. ***Additives in the polymer.*** In general, addition of plasticizers to increase flexibility to the hose (during manufacture) will increase the permeability of the plastic. Addition of inorganic fillers will usually decrease the permeability.
8. ***Degree of crystallinity /density of polymer.*** Density is a measure of the free volume between the molecules of the polymer. In general, the higher the density the lower the permeability. The crystalline structure of the polymer is usually less permeable compared to the amorphous form. Crystallinity and density are strongly related. The higher the crystallinity the higher the density of the polymer. But, more density increases stiffness, giving a less flexible hose).

APPENDIX A